

of this kind, there is no doubt that the author has produced a book of considerable merit, the value of which would be considerably enhanced in future editions if the attempt to deal with the wants of the skilled workman were frankly abandoned.

The text covers most of the elementary operations of the fitting and machine shops, and the graduated exercises are well thought out, and in a well-equipped college workshop under the supervision of a skilled instructor a beginner would no doubt make remarkable progress in the use of tools, and be of real value in a works at the end of the course of instruction.

Steam and other Engines. By J. Duncan. Pp. ix+471. (London: Macmillan and Co., Ltd., 1907.) Price 5s.

THE development of municipal technical schools during the last few years has given a great impetus to the production of books written especially for elementary students. Mr. Duncan's book, on steam and other engines, is an admirable little work of this class, which students in the early part of a course on mechanical engineering will greatly appreciate, for it is well and clearly written, and covers a wide range of modern practice.

There is nothing more attractive to young engineering students than the purely mechanical details of engines, and the wealth of illustrations accompanying the descriptive matter will no doubt prove of great interest.

While the illustrations are a prominent feature of this book, the more important elementary principles of heat-engine theory and applied mechanics are also presented in a very skilful manner. Students working through the course of instruction prescribed, especially if they are able to carry out the experiments and take part in the engine and boiler trials, as the author recommends, will obtain quite a considerable knowledge of steam and other heat engines.

There appear to be very few errors or mistakes of any importance, but occasionally the author is not an accurate guide, as, for instance, when dealing with the flow of steam in an expanding nozzle he incidentally says that "In the case of a liquid the problem is simple as the property of expansibility is absent," a statement in direct contradiction to the actual facts, as students of hydraulics are well aware.

The Elements of Mechanics. A Text-Book for Colleges and Technical Schools. By W. S. Franklin and B. Macnutt. Pp. xi+283. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1907.) Price 6s. 6d. net.

A BOOK on elementary mechanics, which commences by addressing the reader as my young friend, and immediately after, in a lengthy paragraph, draws a comparison between the student and the axolotl, does not seem very promising as a scientific work. This feeling is strengthened when a little further on, in speaking of the laws of motion, one of the authors writes:—

"You, my young friend, must have in some measure my own youthful view, which, to tell the truth, I have never wholly lost, that there is something absurd in the idea of reducing the more complicated phenomena of nature to any orderly system of mechanical law. For to speak of motion is no doubt to call to your mind first of all the phenomena that are associated with the excessively complicated, incessantly changing, turbulent and tumbling motion of wind and water. These phenomena have always had the most insistent appeal to us; they have confronted us everywhere and always, and life is an unending contest with their fortuitous diversity, which rises only too often to irresistible sweeps of destruction

in fire and flood, and in calamitous crash of collision and collapse where all things commingle in one dread fluid confusion."

The book does not, happily, continue in this style after the opening chapter, but commences a systematic treatment of elementary mechanics on familiar lines, which, however, does not present any new features worthy of notice, except that inaccuracies and lack of precision in the statement of scientific principles are numerous. A new text-book on mechanics may be justifiable, if the authors can present the subject in a better way than has been presented before, or in a form more adapted to the wants of its readers, but a comparison of this work with any good elementary treatise on the subject cannot fail to show its inferior character. E. G. C.

Die Lösung des Problems der Urzeugung (Archigonia, Generatio spontanea). By Martin Kuckuck. Pp. vii+83; with 34 figs. and one table. (Leipzig: Barth, 1907.) Price 3 marks.

DR. KUCKUCK made a mixture of gelatine, peptone, asparagin, glycerine, and sea-water, boiled it for an hour, put it in a sterilised vessel, and added a little chloride of barium, which brought about ionisation. The outcome was the formation of minute bodies like protozoa, which show "nutrition, growth, reproduction (segmentation), inheritance, movement (rotation), and form cell-groups (coenobia of Haeckel), which resemble animal morulae." Barium chloride produces similar morulae in fresh white of egg and in yolk of egg. Drops of natrium nucleinecum (Merck), allowed to fall on the surface of the gelatine-peptone-asparagin-glycerine-sea-salt mixture, produce rotating corpuscles, which form loose colonies. The author gives very interesting and striking figures, some drawn, some from photographs, of his artificial cells and cell-colonies. The figures drawn from the artificial morulae would pass muster in a text-book of embryology; the cell-outlines are sharply defined, and each cell has a beautiful nucleus. It seems to us that these and similar experiments would be more interesting, if less were proved.

On this experimental basis, Dr. Kuckuck rears a theoretical superstructure. Mixtures of inorganic and organic substances pass by ionisation into protoplasm. Salts of barium, radium, and nuclein effect this ionisation. The process of organisation is a process of ionisation. It is so now, and it was so in the beginning. The first organisms arose in the sea and were non-nucleated Monera. The nucleated cell arose by the symbiosis of two aniso-electrical non-nucleated cytodes, as is proved by the fertilisation-process, for is not ontogeny a recapitulation of phylogeny? "Everything living has sex (negative and positive ions), and everything is living because it has sex (negative and positive ions): ohne Geschlecht kein Leben." A sort of genealogical tree is given showing the origin of organisms from inorganic substances, so that the Stammbaum is now quite complete, even as to its roots. J. A. T.

The Flora of Columbia, Missouri, and Vicinity. By F. P. Daniels. The University of Missouri Studies. Science Series, vol. i., No. 2. Pp. x+319. (The University of Missouri, 1907.)

As a study of a local flora, this memoir, furnishing a list of the plants and an ecological survey, forms a suitable volume for the science series of the Missouri University publications.

The flora is characterised by a predominance of genera belonging to the orders Compositæ, Gramineæ, and Leguminosæ. The sedges are numerous, since the species of *Carex* exceed fifty. *Desmodium*, *Mes-*

pilus, and Aster are large genera, and Vernonia provides eight new species. The genus *Quercus* is important both for the number of species and also on account of their dominance in the forests of the area. *Q. alba*, the white oak, *Q. rubra* and *Q. Schneekii*, red oaks, are widely distributed; *Q. macrocarpa*, *Q. platanoïdes*, and *Q. palustris* occur on the coal measures; *Q. acuminata* and *Q. tinctoria* are also common.

The ecological survey is detailed, almost too detailed, as it loses conciseness owing to the multifarious subdivisions. The forests, as the prevailing features of the district, receive the most attention; the cliff and marsh associations are also important. The characters of the various formations are carefully delineated, and the text furnishes an estimable addition to the literature of plant distribution, but the area has apparently not been surveyed with the view of plotting on a map, nor are any illustrations provided.

The Evolution of Matter, Life, and Mind. By W. Stewart Duncan. Pp. 250. (Philadelphia: Index Publishing Company, 1907.)

THIS is a *vade mecum* of evolutionism, a sequel to a previous volume in which the author sought to show that feeling and energy are alternate states of matter everywhere. Feeling is given out as energy, and energy is experienced as feeling. Both are spiritual or non-substantial, sister properties or manifestations capable of inhering and co-inhering in one universal substance, the ether. The progress of investigation has enabled the author to make his monism even more definite. Matter is being refined away into a mode of motion in the ether. This ether is "the fountain of all being," "the hitherto unknown God." Prof. Larmor and others are theologians in spite of themselves. Helped by abundant quotations, Mr. Duncan gives a sketch of recent investigations as to the nature of matter, and he points out that he anticipated some of them. In 1893, for instance, he contended that an ordinary ray is a succession of such motions of the ether as beget waves with *longitudinal* as well as *transverse* elements of vibration, and it was only last year that Prof. J. H. Poynting showed that rays of light do exert energy in the direction of propagation. In the present volume he develops some original speculations, e.g. a theory of radiation and gravitation.

The author tells us that we must believe in the spirituality of matter and of the ether. Physical processes are *never* complete chains of sequence. Feeling and energising arise alternately in all matter. Animal matter has sprung from vegetable matter, and the latter from inorganic matter (in the Arctic regions). All that we call "matter" is at least sensitive and capable of feeling. It is so because of what it produces, and it is so because the ether is the fountain of all being, physical and mental. Every receiver of energy passes through two states, which correspond to those of every living personality, a subjective state of feeling which results from influence from without, and an elective state of energising which results from influence from within. We trust that this is all quite clear.

Mr. Duncan gives an account of the origin of everything—including evil—except the ether, which is a scientific name for God. He traces the evolution of all living creatures and of the human mind, showing that the difficulty of thinking out the long genetic process may be in great measure overcome if we start from a broad enough basis—the psychosis of "matter." In the course of his exposition he quotes the story of a delightful orchid, discovered by Mr. E. A. Suverkrup, of Philadelphia, which sends down a tubular stem into the water when it is thirsty, fills

the tip, and coils it up again. "As the last coil is made the water trickles down upon the roots at the other end." When the discoverer touched the leaves, he was "astonished to see the centre stem convulsively coil itself into a spiral like the spring of a watch." Wonders will never cease. Nor is pathos wanting, for on dry ground "it was almost pitiable to see how the tube would work its way over the ground, in search of water that was not."

Ballistic Experiments, from 1864 to 1880. By the Rev. Francis Bashforth. Pp. 33. (Cambridge: University Press, 1907.) Price 1s.

THE pamphlet is interesting reading as an unconscious revelation of the timidity of thought of our military authority. Afraid to trust its opinion, it waited for approbation to come from abroad before expressing a judgment.

Although carried out with our muzzle-loading guns, Mr. Bashforth's experiments were so careful as to require slight modification only to serve for the newest pattern of modern artillery, and the arrangement of his tabular matter for practical use has been adopted universally, and is never likely to be displaced.

Mr. Bashforth is the creator of the science of modern artillery, but our official world considers this a very improper remark to make, at least in his lifetime.

The rapid progress in electromagnetic science has made possible a great improvement in the chronograph, and further experiment is needed urgently if we are to make the best use of manufacture in the production of improved weapons of war.

LETTERS TO THE EDITOR.

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The Origin of Radium.

IN his two interesting letters published in NATURE of September 26 and October 10 respectively, Dr. Boltwood states that he has obtained undoubted proof of the existence of the parent substance of radium, and that he finds it to be allied in chemical properties with thorium. I may be permitted to describe some experiments which afford independent evidence that the parent substance of radium possesses in a chemical sense the properties of thorium, and that it occurs with the latter.

In experiments made with a new intermediate product obtained from thorium to which I have given the name "mesothorium," I was struck by the fact that old preparations of pure thorium contained relatively large quantities of radium. This appeared all the more noteworthy since the monazite sand from which the thorium is prepared contains only a very small quantity of uranium; the radium corresponding to this small amount must consequently have been separated from the thorium during the complicated processes used in extracting the latter.

A few months ago, therefore, I began a systematic investigation of the quantity of radium in samples of thorium salts of different ages. A weighed quantity of the pure nitrate, generally 10 grams, was dissolved in pure water, and the solution boiled and sealed up. After a sufficient interval the radium emanation was collected by boiling the solution, and shortly afterwards, after allowing the thorium emanation to decay, transferred to an electroscope and measured. Samples of thorium nitrate of very different but accurately known ages were placed at my disposal by the firm of Dr. O. Knöfler. It was found as a result that the older the sample the larger was the quantity of radium contained in it. The oldest sample of all, one dating from 1898, contained the greatest amount. In quite a new sample the quantity of radium was very small, 100 grams of the sample